Water Management Plan

United States Environmental Protection Agency
National Vehicle and Fuel Emissions Laboratory
2565 Plymouth Road
Ann Arbor, Michigan 48195

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EPA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NATIONAL VEHICLE AND FUEL EMISSIONS LABORATORY

WATER MANAGEMENT PLAN

Approved by:

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Steven V. Dorer, Facility Manager Date

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Fidel Galano Jr., Manager, Facilities Services Group Date

TABLE OF CONTENTS

Page

1.0 EPA'S STATEMENT OF PRINCIPLES ON EFFICIENT WATER USE

In order to meet the needs of existing and future populations and ensure that habitats and ecosystems are protected, the nation's water must be sustainable and renewable. Sound water resource management, which emphasizes careful, efficient use of water, is essential to achieve these objectives.

Efficient water use can have major environmental, public health, and economic benefits by helping to improve water quality, maintain aquatic ecosystems, and protect drinking water resources. As we face increasing risks to ecosystems and their biological integrity, the inextricable link between water quality and water quantity becomes more important. Water efficiency is one way of addressing water quality and quantity goals. The efficient use of water can also prevent pollution by reducing wastewater flows, recycling process water, reclaiming wastewater, and using less energy.

EPA recognizes that regional, state, and local differences exist regarding water quality, quantity, and use. Differences in climate, geography, and local requirements influence the water efficiency programs applicable to specific facilities. Therefore, EPA is establishing facility specific Water Management Plans to promote the efficient use of water and meet the water conservation requirements under Executive Order 13123, Greening the Government Through Efficient Energy Management.

This Water Management Plan has been established to document and promote the efficient use of water at the U.S. EPA National Vehicle and Fuel Emissions Laboratory in Ann Arbor, Michigan. The plan is organized according to the Federal Energy Management Program (FEMP) Facility Water Management Planning Guidelines under Executive Order 13123.

2.0 FACILITY DESCRIPTION

The US EPA National Vehicle and Fuel Emissions Laboratory (NVFEL) facility is located in Ann Arbor, Michigan. The 174,542 square foot building was constructed in 1970 to house offices, testing laboratories, and support spaces. The laboratory and support spaces occupy a high-bay building subdivided into 20 individual test cells, 4 soak zones where vehicles are maintained at constant temperature conditions, and support and preparation areas. Offices occupy the three wings off the high-bay building. The facility is owned and operated by EPA.

Some NVFEL staff occupy a leased office building adjacent to the laboratory. This plan does not address any aspects of the leased office building; it focuses on water management at the laboratory facility owned and operated by EPA.

NVFEL is part of the Office of Air and Radiation, Office of Transportation and Air Quality (OTAQ). The lab provides OTAQ with emission testing services for motor vehicle, heavy-duty engine, and nonroad engine programs in support of rulemakings, enforcement actions, and procedures development. Testing activities include:

- certifying that vehicles and engines meet federal emissions and fuel economy standards;
- testing engines for in-use compliance; and
- analyzing fuels, fuel additives, and exhaust compounds.

In addition, the lab assists in the development of automotive technology to reduce conventional pollutants and greenhouse gas emissions, such as the Clean Care Automotive Technology Program, low NOx diesel engine, and alternative fuel technologies.

EPA awarded its first energy savings performance contract (ESPC) to NORESCO in 1998 for a comprehensive upgrade to the energy systems at NVFEL. This project has completely replaced the building's heating and cooling infrastructure, significantly reduced energy and water consumption, and lowered facility maintenance and utility costs. Key components of the ESPC included replacing 36 rooftop air handling units, replacing existing equipment in the central heating and cooling plant with one new 440 ton, and one new 575 ton direct fired chiller-heater absorbers, one new high efficiency condensing boiler, two new cooling tower cells with variable frequency fan drives, and a new pumping system. The upgraded chilled water system was sized to replace previous use of once-through cooling water with recirculated chilled water.

The ESPC project, conducted in partnership with the Department of Energy's Federal Energy Management Program, and the National Renewable Energy Laboratory, has achieved over 50% reduction in energy consumption and over 78% reduction in water consumption compared to baseline conditions (FY 2002 compared to FY 1993 to 1995 baseline).

3.0 FACILITY WATER MANAGEMENT GOALS

NVFEL has achieved 78% reduction in water use through the recent implementation of its ESPC. Further definition of water management goals of will be achieved through the implementation of the NVFEL Environmental Management System (EMS). The EMS is being established consistent with the NVFEL Environmental Policy Statement. The NVFEL Environmental Policy Statement and water conservation goals are provided below.

Environmental Policy Statement

The NVFEL is committed to giving our employees and others on our site a safe environment. The health and welfare of those who work at NVFEL is a top priority, and is an integral part of our mission to protect the environment and serve the American public. Our Safety, Health, and Environmental Program (SHEMP) is designed to ensure the integrity of our commitment through the following principles:

Compliance

We will meet and exceed regulatory compliance standards, and increase our current programs to assure compliance. To achieve our goal of meeting and exceeding compliance, we will promote environmental awareness among our employees through training, and expect every employee to take responsibility for fulfilling environmental objectives. Further, we will inform our vendors, suppliers, and contractors of our environmental requirements, and encourage them to comply with similar policies. We will favor vendors who operate with sound environmental principles.

Prevention

We will foster the sustainable use of our local natural resources by preventing pollution, reducing waste, and recycling. Whenever possible, we will do so through source reduction. We will insist on safe operating procedures, intelligent recycling/disposal of waste, and we will be fully prepared for emergencies that threaten these standard operational procedures.

Environmental Stewardship

We are EPA, and we will set the example for others to follow. We will demonstrate our commitment to reduce/reuse/recycle, and will share our success stories with others. As a community member and leader, we will strive to teach by doing - our work will be a model for others, and we will share our experience locally and broadly.

Continual Improvement

We will seize opportunities to go beyond defined requirements and adapt to changing situations and emerging concerns. We will lead by example, self-correct, and share our lessons with others.

Water Conservation Goals

The ESPC, initiated in 1998 and fully implemented in 2000, has resulted in significant energy and water conservation savings. Through the complete upgrade of the facility HVAC system and installation of chilled and hot water recycle loops, facility water consumption has been reduced by 78% over baseline conditions (FY 2002 compared to FY 1993 to 1995 baseline).

NVFEL is currently implementing an EMS and is in the midst of identifying and evaluating all of its environmental aspects, including water use. Further conservation goals and performance measures will be established as the EMS is developed for those aspects and impacts that are determined to be significant.

4.0 UTILITY INFORMATION

Contact Information

Potable water is provided by:

City of Ann Arbor Water Utilities
100 N Fifth Avenue
PO Box 7014
Ann Arbor, MI 48107-7014

(734) 994-2666

Sewer Service is provided by:

City of Ann Arbor Water Utilities
100 N Fifth Avenue
PO Box 7014
Ann Arbor, MI 48107-7014

(734) 994-2666

Rate Schedule

The water billing rate is $1.97 per 100 cubic feet.

The sewer use fee is $2.25 per 100 cubic feet.

A monthly fee of $512.76 is assessed by the water utility for storm water.

Payment Office

U.S. EPA— NVFEL
Attn: Account Operations
26 West M L K Drive
Cincinnati, OH 45268

(513) 487-2063

5.0 FACILITY INFORMATION

The predominant feature of the NVFEL laboratory is the high-bay research space, where vehicles and engines are subjected to a variety of performance tests in individual test cells and soak zones. Engines tested vary in size, ranging from string trimmers to over the road diesel engines. Central plant utilities account for approximately one half of total facility water use, the vast majority of which is for cooling tower make-up. Other significant uses of water include water used for braking power in some of the test dynamometers, water used for wet scrubbing of engine exhaust from the diesel engine test cells, and water used for sanitary purposes. The facility is not equipped with an irrigation system; therefore, virtually no water is used for landscape irrigation.

Major Water Using Processes

Average water use in FY 2002 by major process is shown in Table 1.

Table 1
Major Water Using Processes

Major Process	Annual Consumption (gallons)	Percent of Total	Comments
Cooling tower make-up	3,453,660	55.3	Metered
Chilled water loop make-up	98,660	1.6	Metered
Hot water loop make-up	7,200	0.1	Metered
Air Humidification	139,492	2.2	Metered
Wet Scrubber	1,200,000	19.2	Engineering estimate based on instantaneous flow meter reading
Dynamometer braking, single pass cooling and other process water use	747,205	12.0	By difference
Sanitary	600,000	9.6	Engineering estimate
TOTAL	6,246,217	100.0	Metered

A chart showing the progressive downward trend in monthly water consumption, achieved as the ESPC was fully implemented, is provided in Appendix A. The chart in Appendix A also shows the seasonal variation in water use, as the majority of total water use is for cooling tower make-up, which peaks during the summer months.

Measurement Devices

Incoming city water supply is metered. Flow totalizing meters are also installed on many of the subsystem flows in the central utility plant, including cooling tower make-up water, chilled water loop make-up, hot water loop make-up, water used for humidification, and domestic hot water. Flow totalizer readings are recorded daily in the utility plant operator's notebook.

Flow data from all meters will be reported at least monthly to the facility manager and water use trends will be monitored on an ongoing basis. Unexpected changes in water use will be investigated and resolved.

Shut-off Valves

6 inch city supply line shutoff is located west of the equipment room 522 in the berm of the City easement, and the building shutoff is located inside the building on the north wall of room 522.

Occupancy and Operating Schedules

Approximately 200 to 225 employees work at NVFEL. The laboratory operates on a flex time schedule and is typically occupied between 5:00 a.m. and 6:00 p.m., Monday through Friday.

6.0 BEST MANAGEMENT PRACTICE SUMMARY AND STATUS

The Federal Energy Management Program (FEMP) has identified water efficiency improvement Best Management Practices (BMPs) in ten possible areas. Implementation of BMPs in four or more areas are required under FEMP guidance. NVFEL has adopted and will maintain BMPs in seven of the ten areas:

- ✓ Public Information and Education Programs
- ✓ Distribution System Audits, Leak Detection and Repair
- ✓ Water Efficient Landscape
- □ Toilets and Urinals
- ✓ Faucets and Showerheads
- ✓ Boiler/Steam Systems
- ✓ Single-Pass Cooling Systems
- ✓ Cooling Tower Systems
- □ Miscellaneous High Water-Using Processes
- □ Water Reuse and Recycling

Public Information and Education Programs (BMP #1)

NVFEL promotes water and energy conservation and awareness using the FEMP Lead by Example poster series. Conservation posters are displayed in prominent locations throughout the building. Employees are educated on water conservation topics though the implementation of the ESPC. In particular, employees are trained to use the recirculating chilled water loop installed as part ESPC, rather than single pass city water, as a source of cooling water. In addition, all group managers participated in a careful examination of facility water use as part of the ESPC planning process. External to the laboratory, water and energy conservation achievements of NVFEL are featured in public forums such as EPA's LABS 21 Conference and DOE's Energy 2001 - Energy Efficiency Workshop and Exposition. NVFEL also has shared its accomplishments at the annual EPA Buildings and Facilities Conference.

Distribution System Audits, Leak Detection and Repair (BMP #2)

A screening level system audit was conducted in October 2002, and known water uses account for greater than 90% of water consumption.

Make-up water use in chilled and hot water recycle loops is metered and recorded daily. Unanticipated changes in water use are investigated by the energy savings performance contractor and resolved.

Facility staff are trained to report leaks and malfunctioning water using equipment to a facility maintenance help line. Reported problems are assigned a work order, which is completed by the facility operation and maintenance contractor. In addition, the facility operation and maintenance contractor performs a weekly inspection of all sanitary fixtures to maintain and ensure proper operation.

Water Efficient Landscape (BMP #3)

No irrigation is used to maintain facility landscaping. Grassy areas are allowed to brown out during dry periods, and are naturally restored when precipitation occurs.

Toilets and Urinals

Low-flow fixtures (1.6 gpf toilets and 1.0 gpf urinals) with automatic flush valves have been installed in a renovated men's room and a renovated women's room in the main office wing of the building (Zone 1). Older style toilets and urinals, installed as part of the original laboratory construction in 1970, are still in use in the laboratory area (Zone 2). These rest rooms have been identified for a future renovation when an EPA building and facilities appropriation becomes available. Best management practice status will be achieved in this area once this renovation is complete. As a preventative maintenance measure, all flush valves in Zone 2 toilets and urinals are replaced once per year.

Janitorial staff and employees are trained to report leaks or other maintenance problems, which are immediately corrected. In addition, the facility operation and maintenance contractor performs a weekly inspection of all sanitary fixtures to maintain and ensure proper operation.

Faucets and Showerheads (BMP #4)

Ultra low-flow faucets (0.5 gpm) with automatic sensors to control flow have been installed in the renovated men's room and renovated women's room in the main office wing of the building. Low-flow faucets (2.2 gpm) are installed in other building lavoratories. Low-flow shower heads (2.5 gpm) are installed in the shower room. System pressure is maintained between 20 to 80 pounds per square inch.

Janitorial staff and employees are trained to report leaks or other maintenance problems, which are immediately corrected. In addition, the facility operation and maintenance contractor performs a weekly inspection of all sanitary fixtures to maintain and ensure proper operation.

Boiler/Steam Systems (BMP #5)

Prior to the ESPC, three 700 HP boilers produced steam at 100 psi, which was distributed to the facility at 35 psi via a pipe loop. Boiler make-up water accounted for approximately 1,000,000 gallons per year of facility water. This system was replaced with high efficiency condensing boilers, and a new hot water piping distribution system installed. This heating plant upgrade eliminated steam condensate blowdown and significantly reduced make-up water demand. Hot water loop make-up now accounts for only 7,200 gallons per year of facility water consumption.

Single Pass Cooling Equipment (BMP #6)

Prior to the ESPC, single pass cooling water was used to cool the building air compressors and process chillers, and to remove the heat load from engines being tested. These uses accounted for approximately 23,000,000 gallons per year in water consumption. As part of the ESPC, an upgraded cooling plant was installed which included a recirculated chilled water loop designed to provide cooling for all these applications. Recirculated chilled water is now used for cooling the air compressors and process chillers. Recirculated chilled water is also available in each engine test cell and almost all have been converted to using the chilled water system for engine cooling. One or two test cells remain to be converted, pending the aquistion of the necessary heat exchangers and controls to hook the engines being tested to the chilled water loop. In total, use of single pass cooling water has been reduced by over 95% through the upgrade to the chilled water system under the ESPC.

Cooling Tower Systems (BMP #7)

A new cooling tower system was installed under the ESPC, consisting of two cooling tower cells with variable frequency fan drives, new pumping systems, and associated controls. The cooling tower system is equipped with an ozone treatment system to reduce biological growth, and a side stream sand filtration system to reduce solids build-up and enable a higher degree of cooling water recycle. Cooling tower make-up water use is metered and the flow is recorded daily. Tower blowdown is controlled based on water conductivity; the conductivity target for the system is 1800 *u*S/cm. This conductivity control point provides for approximately four cycles of concentration and efficient cooling tower water use.

The cooling tower maintenance contractor is informed that water conservation is an operational goal of the facility. The contractor routinely monitors the cooling system water quality for optimum performance.

Miscellaneous High Water-Using Processes

Process water is used at NVFEL to place a resistance load on chassis test dynamometers. NVFEL has approximately 5 to 6 of these dynamometers in service, but they are being replaced at a rate of about 1 to 2 per year with dynamometers that use electric resistance rather than water resistance. This rate of this changeover is controlled by vehicle testing protocols and requirements.

Exhaust from the diesel engine test cells is routed through a packed-bed wet scrubber to remove particulate from the exhaust stream. The scrubber packing is continuously wetted by recirculating water from a catch tray below the packing to the top of the scrubber. Fresh water is continuously fed to the base of the catch tray and overflows to drain, removing particulate matter captured by the scrubber. The facilities services team is currently conducting an engineering study to evaluate the best approach to air pollution control on the exhaust from the diesel engine test cells. Efficient use of water will be considered as an aspect of this engineering study.

7.0 DROUGHT CONTINGENCY PLAN

Water shortages are uncommon in Ann Arbor due to an abundant water supply. The City of Ann Arbor does not have an official water management plan specifically for droughts, but it does have a general emergency action plan, which may be implemented if a drought occurs. Historically, the only action that has been taken during previous droughts has been the restriction of landscape watering. NVFEL does not use any water for landscape irrigation.

In the event that voluntary or mandatory water consumption reductions are instituted by Michigan Department of Natural Resources or City of Ann Arbor Water Utilities, NVFEL will form a task force of facility and operating personnel to identify and implement modifications to facility operations to achieve additional specified reductions in water consumption.

8.0 COMPREHENSIVE PLANNING

Under the existing NVFEL Policy for Approval of Facility Changes and Modifications, any material changes to the NVFEL facility require participation and review by the Facilities Services Group Manager during the planning process, including sign-off by the Facilities Services Group Manager before the project is approved for implementation. As part of this review, the Facilities Services Group Manager will ensure that water efficiency BMPs are taken into account during the initial stages of planning and design for any facility modifications, renovations or new construction. Water efficiency BMPs will also be considered prior to the purchase and installation of any equipment that would measurably change facility water consumption.

9.0 OPPORTUNITIES FOR FURTHER WATER CONSERVATION

NVFEL is pursuing the following projects to achieve additional reductions in water use:

1) Diesel Exhaust Scrubber Optimization. The existing wet scrubber appears to consume a continuos water flow of 2.2 gpm, which would account for 20% of total facility water consumption. As part of an engineering review and upgrade to the diesel engine test cell exhaust system, scrubber operation will be evaluated, and options to replace the scrubber with more efficient equipment will be considered. If the wet scrubber is left in place, scrubber operation and maintenance will be examined to reduce the flow rate to the scrubber without creating a negative impact on scrubber performance.

2) Zone 2 Rest Room Renovation. Zone 2 rest rooms will be renovated to include low-flow sanitary fixtures when the necessary building and facilities appropriation becomes available.

3) Convert from Water Resistance Dynamometers. When remaining water resistance dynamometers are replaced with upgraded or updated equipment, “dry” equipment will be specified unless water resistance dynamometers are required by the testing protocol.

4) EMS Implementation. Water use will continue to be considered as an environmental aspect in ongoing EMS implementation. The EMS will be provide a consistent method to ensure each working group within the laboratory considers water use and establishes water conservation goals related to their activities, as appropriate.

APPENDIX A
MONTHLY WATER USE DATA

NVFEL Monthly Water Consumption						
	Baseline					
	1993-1995 avg	1999	2000	2001	2002	
Jan	2,107,257	876,715	980,694	801,162	951,520	
Feb	985,182	1,084,673	729,349	270,794	175,044	
Mar	3,190,433	1,115,343	685,962	397,963	213,194	
Apr	1,262,708	732,341	950,772	662,772	321,662	
May	1,179,675	1,463,934	1,333,025	1,127,311	506,430	
Jun	2,243,402	1,698,074	1,229,794	1,553,700	520,643	
Jul	2,576,284	2,155,880	1,187,903	781,712	781,712	
Aug	2,421,438	2,938,340	2,025,719	1,336,765	783,956	
Sep	1,494,604	1,383,144	2,167,849	930,574	400,207	
Oct	1,437,004	608,165	967,229	586,471		
Nov	2,008,514	997,899	376,269	305,952		
Dec	2,562,071	478,004	249,849	699,427		
Total	23,468,573	15,532,510	12,884,413	9,454,604	4,654,367